West Seattle Bridge Community Task Force

Meeting #11

October 21, 2020

City of Seattle

Agenda

- Welcome and agenda overview
- Bridge Updates
- Reconnect West Seattle 2020 Implementation Update
- Rapid Span Replacement Concept Review
- Repair or Replace: Cost-Benefit Analysis
- CTF discussion on CBA
- Next steps

Please note, audio and video for this event is being livestreamed and afterward will be available online and accessible to media.

Ensuring CTF meetings are accessible

- Use the chat feature sparingly; please raise your “hand” instead if you want to ask a question or make a statement
- Identify yourself every time you speak or ask a question
- If referencing something on the screen, please clearly describe it
- For questions that do make it into the chat, co-chairs/facilitators will name the CTF member and read out the question

Bridge Updates

Heather Marx

October 21, 2020

City of Seattle

Stabilization Measures Underway

Left photo: Rebar cages/forms for deviator blocks. These are embedded into the interior girder floor to provide reinforcement and anchorage. Deviator blocks keep the post-tensioning strands from touching the bottom of the girder as they travel between anchor locations.

Right photo: Looking down from the bridge deck at the work platform under Pier 18.

Reconnect West Seattle 2020 Implementation Update

Sara Zora

October 7, 2020

City of Seattle

Reconnect West Seattle 2020 Implementation Update

Delivery Year	Survey Category	#	Project Name	Project Description	Status
2020	Freight	F03	14th Ave S and S Cloverdale St Improvements	Relocate the stop bars and signal detection and expand the width of the south leg crosswalk	**Complete**
2020	Georgetown	28	Airport Way S Safety Improvements	Add speed radar feedback signs	**Complete**
2020	Georgetown	183	S Michigan St and Corson Ave S	Extend length of northbound right turn lane	**Complete**
2020	SODO	7	East Marginal Way PBL Improvements	Refresh existing bike lane markings, add delineators and green driveway markings	**Complete**
2020	SODO	26	SODO Pothole Repair	Repair potholes along detour routes and other locations	**Complete**
2020	SODO	45195	S Lander St Bridge Acceleration	Accelerate construction of the S Lander St Bridge	**Complete**
2020	South Park	135	South Park Bike and Pedestrian Map	Map of bike and pedestrian routes to access the South Park and 1st Ave S Bridge	**Complete**
2020	South Park	301	S Cloverdale St Safety Improvements	Add speed radar feedback signs	**Complete**
2020	West Seattle	62063	16th Ave SW and SW Holden St Improvements	Add northbound and southbound left turn lanes	**Complete**
2020	West Seattle	W25	Delridge Way SW and SW Orchard St Signal Improvements	Update signal timing	**Complete**
2020	West Seattle	W51	West Seattle Arterial Maintenance	Repair potholes on 35th Ave SW, W Marginal Way SW, SW Delridge Way, SW Holden St	**Complete**

Automated Enforcement

- Installing signs to reflect upcoming photo enforcement this weekend
- Pole mounted cameras at bridge entry points and warning signs
- Cameras capture license plate numbers
- Similar to red-light and school enforcement
- Low Bridge Access Subcommittee created to inform policy

Automated enforcement timeline

- **9/29/2020** — Council Approved Ordinance
- **10/2/2020** — Mayor signed legislation
- **10/23/2020** — Start installing new signs
- **12/1/2020** — Activate automated enforcement system

  (target date)
- **12/1/2020** — Warning notices issued for 30 days
- **1/1/2021** — Violation notices issued ($75)

  (target date)

Traffic Management Questions?

Rapid Span Replacement

Ted Zoli, HNTB

October 21, 2020

City of Seattle

HNTB

West Seattle High-Rise Bridge Rapid Span Replacement Concept

City of Seattle Department of Transportation

HNTB Approach and Lake Champlain Experience

Assumptions for West Seattle Bridge

- Speed and safety are top priorities
- Replacement on existing alignment has major schedule benefits
- Re-use existing substructures to reduce cost and streamline permitting
- Optimize clearances for Duwamish navigation
- Improve seismic performance – seismic isolation
- Minimize navigational impacts – short duration channel closures
- Engineered demolition using heavy-lift techniques
- Demolition and fabrication simultaneously
- Build on successes from Lake Champlain Bridge

Streamlined Construction

HNTB

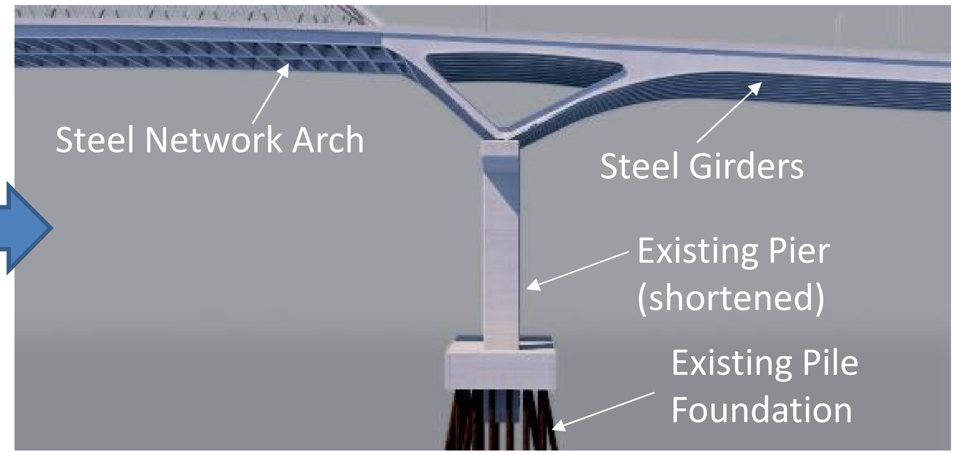
Schedule Risks

- Engineered demolition of the compromised bridge
- Seismic performance – liquefaction/lateral spreading
- Permitting and lead agency identification

- Fast-track funding
- Constrained site – construction engineering

HNTB

Benefits: Enhanced Safety, Long Term Durability



Enhanced Safety

- All members system & internally redundant
- Improved navigation clearance
- Enhanced seismic performance

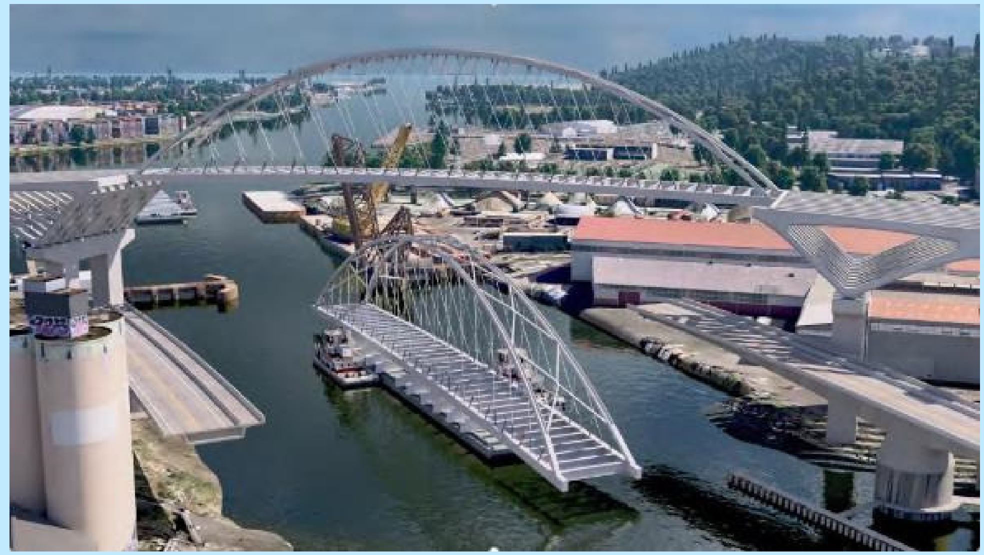
Long Term Durability

- Enhanced corrosion protection
- 100-year design service life
- Replaceable components
- Displacement tolerant

HNTB

Benefits: Reduced Environmental Footprint = Streamlined Permitting

- Potential to eliminate in-water work
- Low navigation impacts for float in float out
- Minimized fisheries impact



- Reduced hazmat impacts
- Foundation strengthening minimized/eliminated
- Opportunity for faster USCG permitting

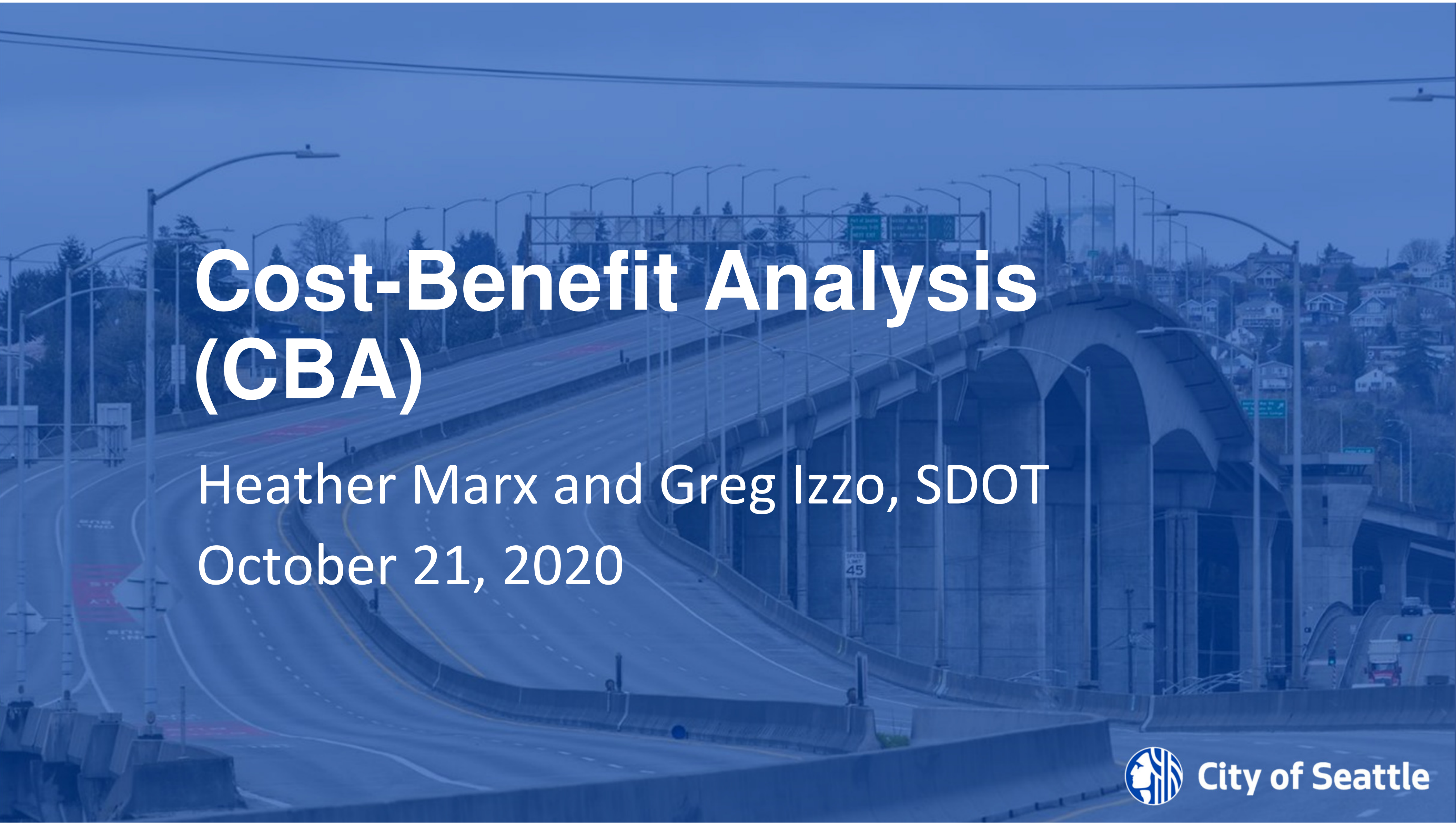
HNTB

Benefits: Accelerated Construction Schedule

- Reuse of existing piers and foundations
- Construction strategy integrated into design
- Arch fabrication concurrent with back span construction
- Outreach to Northwest fabricators/contractors
- Past success with Lake Champlain Bridge in both Cost / Schedule
- Expedited process and efficiency of construction very likely to yield lower construction costs

Activity	Duration	2021	2022	2023-2071	2072	2073-2101
Design Rapid Span Replacement	0.75 Years					
Demolition	0.85 Years					
Fabricate and Install Rapid Span Replacement	2 Years					
New Bridge Service Life	75 Years					
Direct Strengthening	1 Year					

HNTB



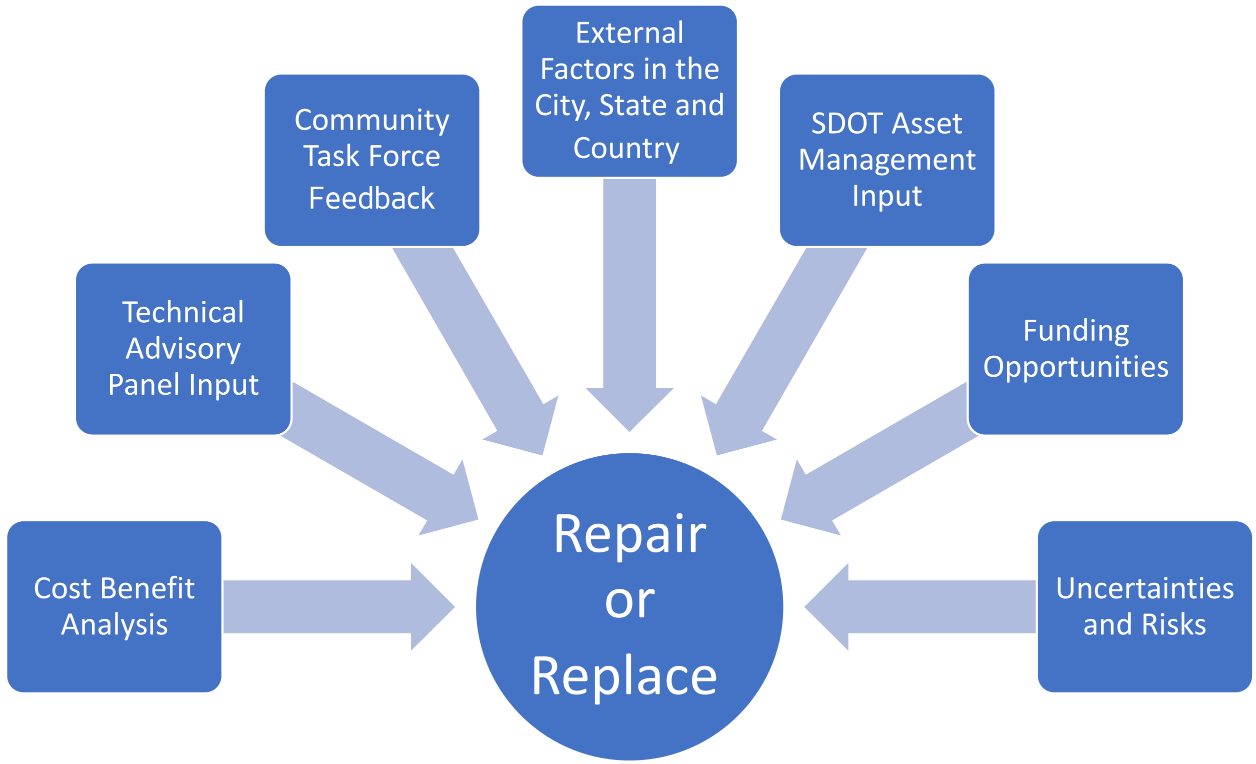
Cost-Benefit Analysis (CBA)

Heather Marx and Greg Izzo, SDOT

October 21, 2020

City of Seattle

CBA analysis is one input for decision making



What the CBA includes

- The CBA provides detailed analysis of each alternative’s performance, costs and risks
- Building on past CTF discussions about performance and risks, today we're focusing on rough order of magnitude conceptual cost data and what the CBA tells us

- **Important notes about cost data**
  - All alternatives were evaluated conservatively
  - Costs reflect 0% design and will change; actual costs generally don’t emerge until 30% design
  - CBA requires us to pick a value, which we would typically share as an estimated range
  - The rapid span replacement concept had not yet been identified when we began the CBA effort

What the CBA does not include

- **Which alternative to choose:** The CBA does not – and was not intended – to yield a specific decision on any alternative.
- **The whole story:** Each CBA component tells only one part of the story; alternatives should be evaluated using all components, as well as factors outside the scope of the CBA.
- **A simple story:** Individual CBA components are more complex than we have time to discuss today as a group. Our goal in this presentation is to summarize the most relevant findings.

Understanding cost data

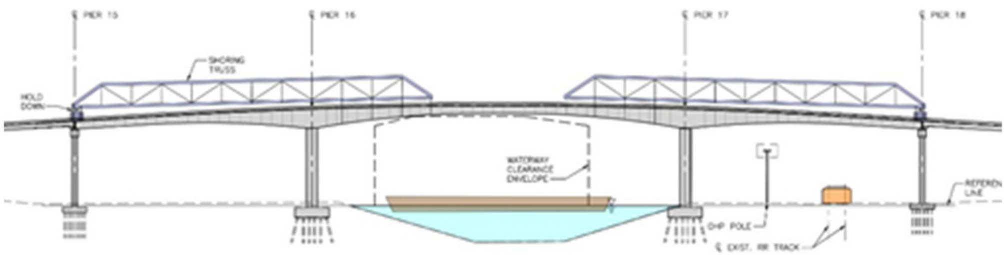
- A combination of capital costs and life cycle costs contribute to the overall "ownership" cost for each alternative

- Capital project cost components:
  - **Construction costs** (demo, construction, contingencies)
  - **Monetized risks** (cost impacts based on probability and impact of risks)
  - **Other costs** (design, permitting, 3rd party review, administration, inspection)

- Life cycle cost components, inclusive of inflation and discount rates:
  - **Operations and maintenance** (monitoring, inspection, standard maintenance)
  - **Repair and rehabilitation costs** (lump sum allowance for future replacement if repair chosen and/or future strengthening if replacement chosen)
  - **Remaining service life** value of the structure after 2100, when the CBA life cycle cost analysis ends)

- Each cost component tells only one part of the story, so alternatives should be evaluated using all components

Alternative 1: Shoring



ELEVATION – SHORING TO RESTORE LIVE LOAD
CONCEPT ONLY, NOT TO SCALE

Activity	Duration	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034-2082	2083	2084-2108
Design Shoring	0.5 Years																
Construct Shoring	3.25 Years																
Traffic on Shored Bridge	5 Years																
Construct New Bridge	3.67 Years																
New Bridge Service Life	75 Years																
Direct Strengthening	1 Year																

- **Estimated Total Ownership**: $1558.9M
- **Estimated Upfront Construction Costs**: $103.5M
- **How long could it take?** Could return partial traffic by late 2024
- **How long could it last?** 5 years
- **Biggest Risks/Drawbacks**:
    - Complex, costly, short lifespan and long construction duration
    - Does not restore full capacity
    - Still requires replacement = closing the bridge again

Alternative 1: Other Cost details

Alternative	Construction Costs	Monetized Risk	Other Costs (ROW, admin, etc)	Operations and Maintenance (Lifetime)	Repair and Rehabilitation	Remaining Service Life after 2100 (end of the CBA)	Estimated Total Ownership Costs (Life Cycle Costs)
Alt 1 (Shoring)	$103.5M	$0M	$21.6M	$32.3M	$1,525.9M	($124.4M)	**$1558.9M**

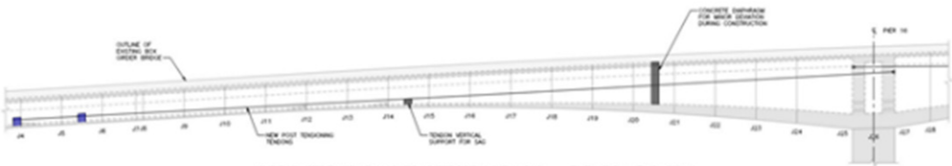
Other key cost highlights:

- No capital cost risks were monetized for Alternative 1

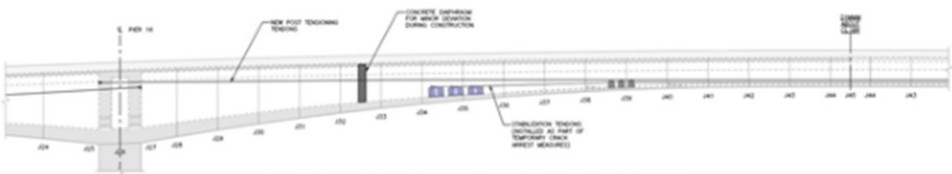
Key question: How much traffic could use the bridge?

- The shoring alternative is only able to restore three to five lanes of traffic to live load

Alternative 2: Repair



DIRECT STRENGTHENING TO RESTORE LIVE LOAD – ELEVATION END SPAN
CONCEPT ONLY, NOT TO SCALE



DIRECT STRENGTHENING TO RESTORE LIVE LOAD – ELEVATION MAIN SPAN
CONCEPT ONLY, NOT TO SCALE

Alternative 2 : Repair 15-Year Lifecycle

Activity	Duration	2021	2022	2023-2031 2032	2035	2036	2037 2038	2038-2113+
Design Rehabilitation	0.5 yrs							
Construct Rehabilitation	1.08 yrs							
Traffic on Rehabilitated Bridge	15 yrs							
Construct New Bridge	3.67 yrs							
New Bridge Service Life	75+ yrs							

- Estimated Total Ownership: $916.0M
- Estimated Upfront Construction Costs: $47M
- How long could it take? Could return traffic in 2022
- How long could it last? 15+ years (see risk below)
- Biggest Risks/Drawbacks:
  - Not confident in duration of repairs
  - Difficult to secure needed annual maintenance funding
  - Seismic performance lower than replacement alternatives
  - Still requires replacement = closing the bridge again
  - Greater uncertainty and more complexity in future (T5, LINK, traffic demand, increased density)
  - Securing funding to replace a functioning (repaired) bridge later perhaps harder than funding a closed bridge now

Alternative 2: Other Cost details

Alternative	Construction Costs	Monetized Risk	Other Costs (ROW, admin, etc)	Operations and Maintenance (Lifetime)	Repair and Rehabilitation	Remaining Service Life after 2100 (end of the CBA)	Estimated Total Ownership Costs (Life Cycle Costs)
Alt 2 (Full Repair)	$47M	$175.4M	$10.9M	$40.5M	$1,279.8M	($637.8M)	**$916.0M**

Key cost highlights: Monetized Risk of $175.4M

- If bridge stabilization measures don't react as predicted: $4.5M
- If repaired bridge has only 15-year service life instead of 40: $171M

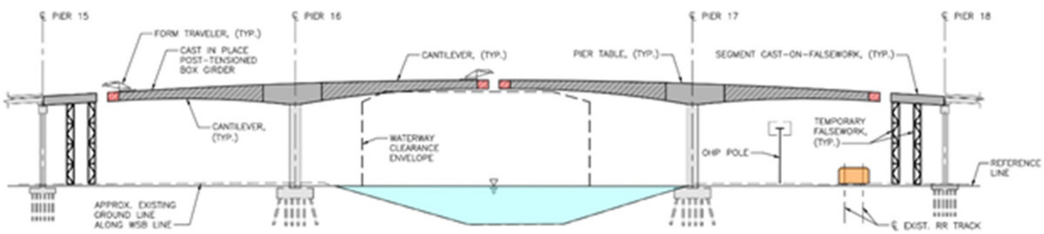
Key question: How long will the repairs last?

- Having adequate Operations and Maintenance resources remains an unresolved challenge for the City
- The 40-year durability assumption in the CBA comes from current AASHTO codes; models show the bridge is responding well to stabilization measures
- Repair duration remains an unknown
- Increased certainty requires further study of how long repairs could last – a ~6-month process for a probabilistic determination

Normal, Essential and Critical Bridges

- These are terms used to convey the classification of a bridge and the requirements it is built to meet in the event of an earthquake. For a high earthquake event:
  - **Normal/Ordinary Bridges**: a reduced number of lanes is available within three months of the earthquake
  - **Essential/Recovery Bridges**: within three months, repairs on a damaged bridge would allow traffic on some portion of the bridge, possibly with vehicle weight restrictions
  - **Critical Bridges**: Within three days, repairs on a damaged bridge would allow traffic on some portion of the bridge, possibly with vehicle weight restrictions

Alternative 4: Superstructure Replacement



ELEVATION – ACCELERATED SUPERSTRUCTURE REPLACEMENT
CONCEPT ONLY, NOT TO SCALE

Activity	Duration	2021	2022	2023	2024	2025	2026	2027-2075	2076	2077-2101
Design Superstructure Replacement	1.5 Years									
Construct Superstructure Replacement	3.83 Years									
New Bridge Service Life	75 Years									
Direct Strengthening	1 Year									

- Estimated Total Ownership: $1005.7M
- Estimated Upfront Construction Costs: $383.1M
- How long could it take? Could return traffic in 2026
- How long could it last? 75 years
- Biggest Risks/Drawbacks:
  - Mobility impacts from longer closure
  - Securing funding; larger up-front capital cost
  - Permitting and regulatory issues could impact schedule

Alternative 4: Other Cost details

Alternative	Construction Costs	Monetized Risk	Other Costs (ROW, admin, etc)	Operations and Maintenance (Lifetime)	Repair and Rehabilitation	Remaining Service Life after 2100 (end of the CBA)	Estimated Total Ownership Costs (Life Cycle Costs)
Alt 4 (Superstructure Replacement)	$383.1M	$229.5	$123.7M	$22.1M	$247.3M	$0M	**$1,005.7M**

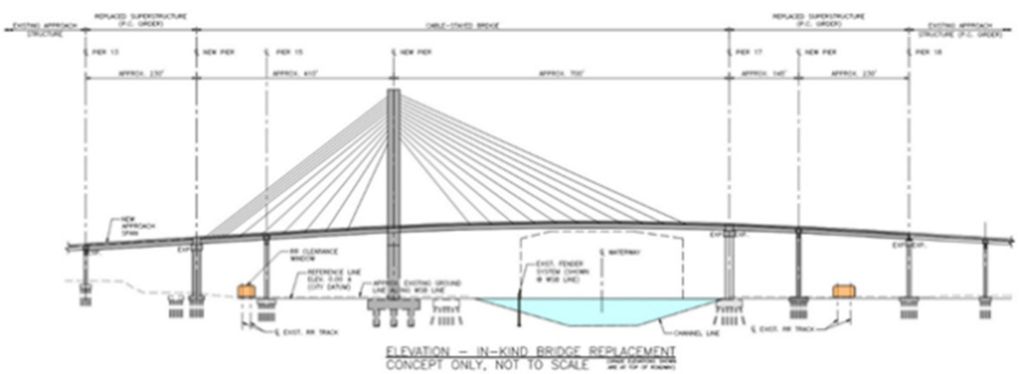
Key cost highlights: Monetized Risk of $229.5M

- Geotechnical standards change: $13.5 million
- The bridge seismic importance classification is CRITICAL instead of ESSENTIAL: $27 million
- USCG has higher vertical clearance requirements: $189 million

Key question: How long will it take to return traffic to the bridge?

- The CBA used the most conservative estimate of 6 years (2026)
- There is a replacement scenario with a potentially faster delivery timeline not explored in the CBA

Alternative 5: Full Replacement (On alignment)



Activity	Duration	2021	2022	2023	2024	2025	2026	2027-2075	2076	2077-2101
Design Replacement Bridge	1.5 Years									
Construct Replacement Bridge	3.67 Years									
New Bridge Service Life	75 Years									
Direct Strengthening	1 Year									

- Estimated Total Ownership: $1,542.7M
- Estimated Upfront Construction Costs: $564.7M
- How long could it take? Could return full traffic in 2026
- How long could it last? 75 years
- Biggest Risks/Drawbacks:
  - USCG clearance risks are higher in Alt 5 than Alt 4
  - Mobility impacts from longer closure
  - Securing funding; larger up-front capital cost

Alternative 5: Other Cost details

Alternative	Construction Costs	Monetized Risk	Other Costs (ROW, admin, etc)	Operations and Maintenance (Lifetime)	Repair and Rehabilitation	Remaining Service Life after 2100 (end of the CBA)	Estimated Total Ownership Costs (Life Cycle Costs)
Alt 5 (Full Replacement)	$564.7M	$473.5M	$208.6M	$29.6M	$282.0M	($15.6M)	**$1,542.7M**

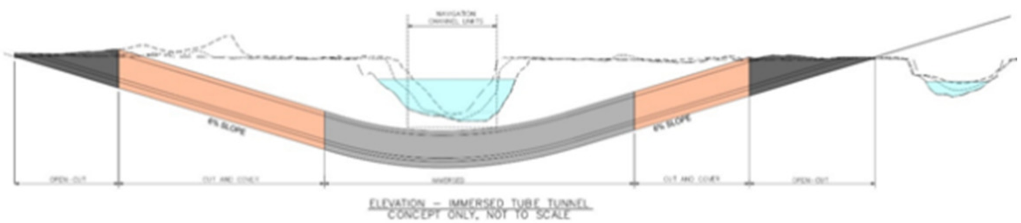
Key cost highlights: Monetized Risk of $473.5M

- Geotechnical standards change: $45 million
- The bridge seismic importance classification is CRITICAL instead of ESSENTIAL/RECOVERY: $90 million
- FAA flight path restrictions require lower bridge height: $149.5 million
  USCG has higher vertical clearance requirements: $189 million

Key question: How long will it take to return traffic to the bridge?

- The CBA used the most conservative estimate of 6 years (2026)
- There may be replacement scenarios with a faster delivery timeline not explored in the CBA

Alternative 6: Immersed Tube Tunnel (Off Alignment)



Activity	Duration	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030+
Design and ROW/Easements	3.5 Years										
Construct Tunnel and Tie-Ins	5.5 Years										
New Tunnel Service Life	75+ Years										

- Estimated Total Ownership: $2,823.6M
- Estimated Upfront Construction Costs: $1,992.1M
- How long will it take? Could return full traffic by 2030
- How long could it last? 75 years
- Biggest Risks/Drawbacks:
  - Environmental: Hazardous materials from dredging the bottom of the Duwamish Waterway
  - Mobility impacts from a long construction duration
  - Securing funding
  - Impacts to Harbor Island
  - Unique asset for SDOT to maintain

Alternative 6: Other Cost details

Alternative	Construction Costs	Monetized Risk	Other Costs (ROW, admin, etc)	Operations and Maintenance (Lifetime)	Repair and Rehabilitation	Remaining Service Life after 2100 (end of the CBA)	Estimated Total Ownership Costs (Life Cycle Costs)
Alt 6 (Immersed Tube Tunnel)	$1,992.1M	$269M	$452.2	$110.3M	$214.5M	($217.1M)	**$2,821.0M**

Key cost highlights: Monetized Risk of $269M

- Geotechnical standards change: $28.5 million
- The seismic importance classification is CRITICAL instead of ESSENTIAL: $35.5 million
- New casting facility: $205 million

Key question: How long would it take to build the tunnel?

- The CBA used the most conservative estimate of 9 years (2030)
- There may be construction scenarios with a faster delivery timeline not explored in the CBA

Attribute Performance

Orange Highlight with * = Highest Performance Amongst Alternatives

Attribute	Alternative 1: Shoring	Alternative 2: Repair (Baseline)	Alternative 4: Superstructure Replacement	Alternative 5: Full Replacement	Alternative 6: Immersed Tube Tunnel
Maintenance, Inspection & Operation	3.7	5.0	7.4*	7.2	3.2
Constructability	2.8	5.0	5.2*	4.1	2.1
Environmental	3.7	5.0*	4.8	3.9	1.3
Equity	2.8	5.0*	4.1	3.2	1.0
Forward Compatibility	2.1	5.0	7.0	8.1*	5.7
Funding Opportunities	5.2*	5.0	4.8	4.3	3.7
Business & Workforce Impacts	3.9	5.0*	3.9	2.3	1.7
Mobility Impacts	3.0	5.0*	4.1	3.9	2.3
Multimodal Impacts	4.1	5.0	6.8*	5.9	4.7
Seismic/Safety	4.6	5.0	7.9	8.8*	8.7

Key issues:

- Highest weighted attributes for Community Task Force are seismic, constructability and mobility
- Any alternative that reduces the time to restore traffic will have a higher score for the environmental, equity, business & workforce impacts, and mobility impact attributes

Speed and durability

Alternative	Restores traffic	Lifespan
Alternative 1 (Shoring)	Partial traffic by 2025	5 years
Alternative 2 (Repair)	2022	15-40 years*
Alternative 4 (Superstructure Replacement)	2026	75 years
Alt 5 (Full Replacement)	2026	75 years
Alt 6 (Immersed Tube Tunnel)	2030	75 years

** Derived life span range, CBA costs based on 40-year lifespan, per AASHTO codes*

Annual O&M Costs

Alternative	Average Annual	Total O&M Costs (2021-2100)
Alternative 1	$409 K	$32.3 M (3.1%)
Alternative 2	$513 K	$40.5 M (4.4%)
Alternative 4	$280 K	$22.1 M (2.2%)
Alternative 5	$375 K	$29.6 M (1.9%)
Alternative 6	$1,397 K	$110.3 M (3.9%)

NOTE:
(x.x%) = total O, M, & I costs as a percentage of total LCCA costs.

- Examples of operations and maintenance costs include:
  - Annual and Specialized Inspections
  - Intelligent Transportation Systems
  - Structural Health Monitoring
  - Painting/UV Protection
  - Ventilation & Fire Protection Systems
- Annual operations and maintenance costs vary between the options
- Securing adequate operations and maintenance resources for Seattle bridges is an on-going challenge and would have to be resolved for the repair pathway

Estimated Total Ownership Costs

Alternative	Estimated Total Ownership Costs (Life Cycle Costs)
Alternative 1 (Shoring)	$1,558.9M
Alternative 2 (Repair)	$916.0M
Alternative 4 (Superstructure Replacement)	$1,005.7M
Alt 5 (Full Replacement)	$1,542.7M
Alt 6 (Immersed Tube Tunnel)	$2,821.0M

Over the total life of the West Seattle High-Rise Bridge, the estimated total ownership costs of Alternative 2 and Alternative 4 are similar.

Quick synopsis: Repair vs. Replace

Repair (Alternative 2)

- Better cost to performance ratio
- Lower capital cost
- Higher maintenance costs
- Quicker return of traffic
- Requires future long-term bridge closure
- Lower attribute performance scores overall, especially in Seismic/Safety
- Success depends on bridge's reactions to repair and stabilization
- Higher risk of resulting in another unplanned shutdown in the future

Replace (Alternatives 4, 5, 6)

- Better performing
- Higher capital costs
- Lower maintenance costs
- Longer return of traffic
- No future long-term bridge closure
- Higher overall attribute performance scores (Alts 4 and 5 only)
- Success doesn't depend on bridge reactions
- Lower risk that the new structure wouldn't achieve its 75+ year service life

Mayor's Goals for the West Seattle Bridge Project

- Protect lives and preserve public safety
- Deliver the safest, fastest solution that provides the greatest certainty and benefit to all communities in and around West Seattle and the city, region, and state
- Identify the pathway with the highest level of certainty
- Minimize the impact of the closure on communities, particularly Black, Indigenous and People of Color communities
- Provide stability and confidence for significant economic investments being made by the Port of Seattle and Northwest Seaport Alliance, Sound Transit and others
- Secure needed funding from Federal and State partners

Task Force Discussion

Your Role as the Task Force

- Provide input and guidance to the Mayor
- Identify pros and cons of the replace vs the repair options
- Share your concerns and considerations with her as she makes this critical decision

Next Steps

- *October 28: Community Task Force completes input*
- *Late October: Co-chairs transmit input to Mayor*
- *November: Mayor shares update on path forward*

Thank you!

www.seattle.gov/transportation/WestSeattleBridge